THE EFFECT OF USING COMPUTER TUTORIALS AS HOMEWORK ASSIGNMENTS ON THE MATHEMATICS ACHIEVEMENT OF ELEMENTARY EDUCATION MAJORS IN BASIC ALGEBRA.

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Method

Subjects: **Ss consisted of 92 volunteer students, 86 females and 6 males at Marshall University in two mathematics courses (101 and 201) for elementary education majors. There were two sections of each, making a total of four classes.**

In the 101 sections, all 53 subjects were full-time students with an average age of 22 years (range=18-43). They had completed an average of 26 semester hours in college (range=0-120), (12 were entering freshmen), with a mean grade point average of 2.98 (range=1.75-3.89), (excluding the entering freshmen). Fifty-one were Caucasians and two were African-Americans. Forty-nine graduated from high schools in West Virginia, Ohio or Kentucky; two graduated from high schools in Michigan and two from high schools in New York.

In the 201 sections, all 39 subjects were full-time students with an average age of 22 years (range=19-44). They had completed an average of 60 semester hours in college (range=26-112), with a mean grade point average of 2.80 (range=1.90-3.80). All students graduated from high school in West Virginia, Ohio or Kentucky.

Independent Variable: The independent variable of this study was Computer Tutorials as homework assignments versus Text-book Exercises as homework assignments. The homework assignments for the experimental groups consisted of a series of nine algebra tutorial programs by Microcomputer Workshops Courseware. These programs were chosen because they competently addressed the specific algebra topics taught in the two courses and found in the textbook. Also, the protocols for responding to the software are simple and consistent making the series easy to use independently by the students. The homework assignments for the control groups were selected exercises from the students' textbook, Mathematics: A Historical and Integrated Approach, by Sasser (1989). Each assignment provided drill upon materials previously covered in class and provided the students with the opportunity of applying the mathematical principles explained in the lecture. The homework

assignments were given to both the experimental and control groups just prior to their leaving class on Tuesdays, and the students were instructed to turn in the completed assignments before class began on the following Tuesday. The homework assignments were evaluated by the instructor, and a percentage grade was recorded. The homework assignments for both groups are described in Appendix A.

Dependent Variable: The dependent variable of this study was the mathematics achievement of students receiving computer tutorials as homework assignments during the course compared to the mathematics achievement of students receiving the traditional textbook exercises as homework assignments.

Mathematics achievement in the context of this study was defined as mastery of selected basic concepts of algebra: linear equations; factoring; binomial multiplication; simultaneous linear equations; fractional linear equations; graphing and quadratic equations, as contained in the class textbook and explained in the lectures. The extent which the students mastered the fore-stated material was determined on the basis of student performance on a test prepared by the instructor.

The posttest instruments used in this study were the same instruments used for the pretest and was administered by the classroom instructor. Prior to the beginning of the experiment, during the first class session, each student was given the test written for their course.

The pre- posttests were constructed by the random generation, by computer, of 25 problems from the nine different programs available to the student. A copy of the test is presented in Appendix B.

Content validity of criterion-referenced measures are related more closely with the item-generation process than with any of the standard indices of validity associated with norm-referenced tests. Content validity of criterion-referenced tests rests with their domain definitions and the item-generation scheme used. Tight, well-explicated domain definitions lead to congruent test items. Items subsequently generated from the experimental materials (Algebra tutorial programs) used by students in the experiment certainly describe the skill and knowledge to be measured.

Procedures: After securing the written consent of all subjects involved, the researcher obtained the permission of the Teacher Education Division Chairperson, College of

Education, Marshall University, Huntington, West Virginia, to conduct the study in two sections of CI 101 (Mathematics For Elementary Teachers I) and two sections of CI 201 (Mathematics For Elementary Teachers II) on Marshall University's main campus, Huntington, West Virginia. One of the two 101 sections and one of the two 201 sections were selected at random to be the experimental groups, leaving the remaining 101 section and 201 section to be the control groups. Groups 101E and 201E consisted of 41 students given Computer Tutorial homework by the instructor once each week, and Groups 101C and 201C consisted of 51 students given selected exercises from the textbook. The course began August 28, 1989 and continued until December 15, 1989.

All four classes met equal number of periods on the same days under the same mathematics instructor. The method of instruction was lectures with opportunity for the students to ask questions at any time.

Students received a syllabus indicating which chapters of the textbook would be studied during each class session. They were additionally, informed which chapters would be covered by the mid-term test and which chapters would be covered by the final examination. Students were informed that all other tests would be announced a week ahead of time.

The only difference between the instruction administered to the groups was the type homework: Computer Tutorials or Textbook Exercises. The instructor prepared all tests and grades for the groups and prepared and graded the homework assignments.

Results

CI 101

A pretest-posttest control group design was used in this study. The t-test was used for statistical analysis of the results of the study.

The findings from the pre- and posttests for CI 101 are summarized in Table I below as follows. The results of the t-test show no statistically significant differences in the pretest scores (t=0.296). The findings of the t-test for the posttests results were significant at the .01 level [t=3.073, df = 51 (df=48 using Welch's Behrens-Fisher Correction), $p < .01$] indicating that students receiving computer tutorials as homework assignments are much more likely to learn more than those receiving the traditional textbook exercises as homework assignments.

TABLE I

Method	N	Mean	Variance	S.D
101E				
CAI Homework				
Pretest	**21**	**9.29**	**60.71**	**7.79**
Posttest	**21**	**20.95**	**10.75**	**3.28**
101C				
Traditional Homework				
Pretest	**32**	**8.66**	**52.36**	**7.24**
Posttest	**32**	**16.75**	**43.48**	**6.60**

CI 201

The findings from the pre- and posttests for CI 201 are summarized in Table II below as follows. The results of the t-test show no statistically significant differences in the pretest scores (t=0.792). The findings of the t-test for the posttests results were significant at the .10 level [t=1.794, df = 37 (df=35 using Welch's Behrens-Fisher correction), p < .1] indicating that students receiving computer tutorials as homework assignments are more likely to learn more than those receiving the traditional textbook exercises as homework assignments.

TABLE II

Method	N	Mean	Variance	S.D.
201E				
CAI Homework				
Pretest	**20**	**4.9**	**12.31**	**3.51**
Posttest	**20**	**18.25**	**46.51**	**6.82**
201C				
Traditional Homework				
Pretest	**19**	**4.05**	**9.94**	**3.15**
Posttest	**19**	**14.05**	**59.83**	**7.74**